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A Case for an ESP Constructivist Approach to Teaching English Writing Courses at Science and Technology Universities

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I. Introduction

This curriculum design study takes place at a school of science & technology in a Japanese university. The needs and preferences of 130 science majors enrolled in a compulsory English writing course were ascertained through the implementation of a survey (see Figure A) at the commencement of the 2016 academic year. This survey helped to facilitate the planning and design of both first and second year writing course curricula. When developing this survey the author outlined 19 different genres of writing, including those for non-academic purposes such as text messaging or advertising, in order to determine all of the students' priorities and wishes in terms of writing in English. All participants attend one of the various science and technology departments at the university. The results show that, of the 20 writing genres available on the survey, the most frequently chosen (60%) option was to compose a written research report on a topic closely related to their own major. Although most students reported neither enjoying writing in English (72%), nor having written in English outside of class (85%), students did express interest in acculturating to a particular discourse and community of practice, in this case the international science communities within the students' respective fields. A detailed discussion of balancing institutional requirements and student needs follows.

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Question 1 (N = 130):*	
What kinds of writing do you want to work on in this class?	
	Number of students/Percent
(1) Writing a research report in English**	78/60%
(2) Writing text messages on your cellphone in English (LINE)	73/56%
(3) Writing an academic essay in English	71/54.6%
(4) Writing business emails in English	61/47%
(5) Writing letters to friends/family abroad in English	47/36.2%
Question 2 (N = 130):	
Do you like writing in English?	Number of Students/Percent
	Yes 37/28.5%
	No 93/71.5%
Question 3 (N = 130):	
Outside of Kangaku, do you ever write in English?	Number of Students/Percent
	Yes 20/15.4%
	No 110/84.6%

* These are the top 5 responses out of 20 choices, including one where students could put their own genre.

**It was explained to students (in Japanese and English) by the teacher that this meant a research report about a topic related to their respective fields of study.

Figure A Survey Questions

II. Learning Theories & Approaches

The second year writing course guidelines state that the required goal of the course is to produce an academic essay that includes the following elements: "an introduction paragraph [with] a thesis statement, well supported and clear body paragraphs [with] topic, supporting and concluding sentences, and a conclusion paragraph [with] restatement of thesis, summary and a punch." This structure closely follows a standard American argumentative essay style. According to the Center for Writing at the University of Minnesota, this type of essay begins "with an introduction that gives a main point (thesis). The thesis is supported by a series of body paragraphs with sub-points, and the essay ends with a conclusion" ("Academic Essay Structures and Formats", No date). Although the writing course guidelines follow a standard academic essay format, this course requirement does not take into account students' future needs as fourth year science students who will join a research laboratory, and may be required to compose research literature reviews, write research reports and present their research in English as well as Japanese. Notwithstanding that a general academic essay can be useful for teaching students how to make citations and think critically about a particular issue, this type of writing may not help students to read, analyze and prepare research reports in English when they are asked to do so by

their laboratory professors, or for their graduation research reports. Writing a counter-argument, for example, is a different writing skill than writing an abstract or a research methodology. Although a general English for academic purposes (EAP) approach may introduce students to a nondescript academe, and possibly help them if they study abroad, a case can be made for a more English for specific purposes (ESP) style approach for the writing courses at science and technology universities in Japan.

Viewing the English classroom through a cognitive constructivist lens, the classroom is seen as "an evolving microculture that does not exist apart from the teacher's and students' attempts to coordinate their individual activities" (Cobb, 1996, p.4). The University of California, Berkeley's teaching and resource center explains that "cognitivist teaching methods aim to assist students in assimilating new information to existing knowledge, and enabling them to make the appropriate modifications to their existing intellectual framework to accommodate that information" ("Cognitive Constructivism", 2016). While there are clear benefits to understanding students' schema and background knowledge in order to modify and increase their knowledge, a purely cognitivist approach may ignore a student's need to become a part of a certain community or academic field. In this case, science majors in Japan, especially those continuing on to graduate school, will need to become a part of their field's research community, where a large percentage of research will be written and conducted in English. A 2012 study that examined the Scopus database with more than 20,000 peer-reviewed journals, including science and technology journals, found that over 80% of the journals were published in English (van Weijen, 2012). While the writing course objectives do guide students into the general academic community, they stop short of facilitating enculturation into the more specific scientific fields of which students will eventually become members.

In contrast to cognitive constructivism, social constructivism, pioneered by Lev Vygotksy (1978), is a learning theory that accounts for the social nature of language and places the learner in a socially mediated context where learning is co-constructed within a particular culture or environment. Essentially, a sociocultural constructivist approach to psychological development uses "the individual's participation in culturally organized practices and face-to-face interactions as primary explanatory constructs" (Cobb, 1996, p.4). Some examples of culturally organized practices in the context of this study are an international conference or a research laboratory. Preparing students in English writing classes to successfully assimilate into a research laboratory's or an international conference's cultural practices (i.e. reading and writing research reports in English or writing a presentation script)

could help students by facilitating their transition into real communities that exist beyond the classroom walls.

Combining elements of both cognitive and social constructionism, the constructivist classroom is focused on building upon and modifying students' knowledge as well as catering to students' future needs in terms of the communities students want to join. Instead of a more traditional teacher-centered approach where students use textbooks and learn using a fixed syllabus designed for all students regardless of major, a constructivist classroom uses primary sources and materials relevant to each student and attends to the needs of individual learners. Instead of the teacher assuming an authoritative role, the teacher assumes the role of the learner as well, finding out about various disciplines and research projects from the students. According to Cooperstein and Kocevar-Weidinger (2004) a constructivist classroom is "guided by four principles－learners construct their own meaning; new learning builds on prior knowledge; learning is enhanced by social interaction; and learning develops through "authentic" tasks－constructivist learning moves from experience to knowledge and not the other way around" (p.141). Science students can then use their in-class experiences and knowledge built in the writing classroom to transition to the research laboratory or international conference.

III. EAP vs. ESP

EAP courses are generally suited to ESL/EFL students studying abroad who wish to enter and earn credits at universities where courses are taught in English. According to the British Council, EAP "entails helping students develop the English skills they need for academic study in a higher education setting" (de Chazal, 2014). Several universities have EAP programs for ESL students who are studying abroad at institutions like Victoria University in Melbourne, whose EAP course is "designed for students with upper intermediate to advanced levels of English who want to gain admission to an Australian TAFE, undergraduate or postgraduate course" ("English for Academic Purposes", 2016). The University of Toronto has a writing course that helps students to learn, among other things, "persuasive writing techniques" and "citation styles" so that students will be able to "produce effective written work for university or college purposes" ("Part-time English for Academic Purposes Courses", 2016). While an argument can be made that some science majors may wish to study abroad and earn general university credits, in actuality few students end up doing so in Japan. According to the most recent MEXT (2015) report on the number of Japanese nationals studying abroad, there were 60,138 students studying overseas in 2012, an almost 30% reduction from 2004's peak of 82,945 students.

According to a JASSO (MEXT, 2015) survey of Japanese students studying abroad in 2013 to 2014, only 1,713 students out of 69,869 students studied abroad for one year or more. Furthermore, the JASSO report (MEXT, 2015) also provides a breakdown of students by major, of whom roughly 60% were humanities majors. Engineering, life and physical science majors, on the other hand, comprised less than 10%. Therefore, according to the latest statistics available, most students who study abroad from Japan are humanities majors and study on short-term courses. This indicates that few students studying science and technology in Japan need general academic writing skills aimed at preparation for university study abroad. The current English writing course guidelines at the university in this study reflect the above cited university program's EAP course goals, in that there is an argumentative essay requirement for the curriculum. Science students in Japan, however, may have little use for persuasive writing techniques, especially if they need to prepare to write a presentation script to explain their research at an international conference. A more tailored ESP approach, then, may be better suited to science majors.

Dudley-Evans & St. John (1998) define ESP as: designed to meet specific needs of the learner; intended to utilize and mimic the activities (such as presenting ones research at a conference) of the discipline it serves; and focused on the appropriate language used in the activities in terms of lexico-grammatical functions, discourse and genre. Applied to science students in Japan, who have the task of explaining their research in English in their 4th year, this means they will need grammar and

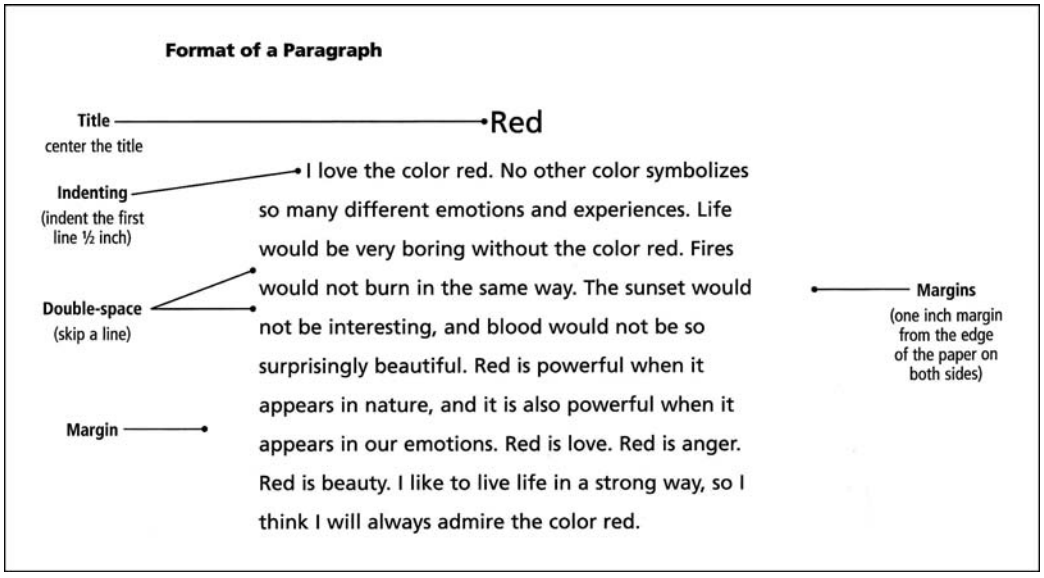
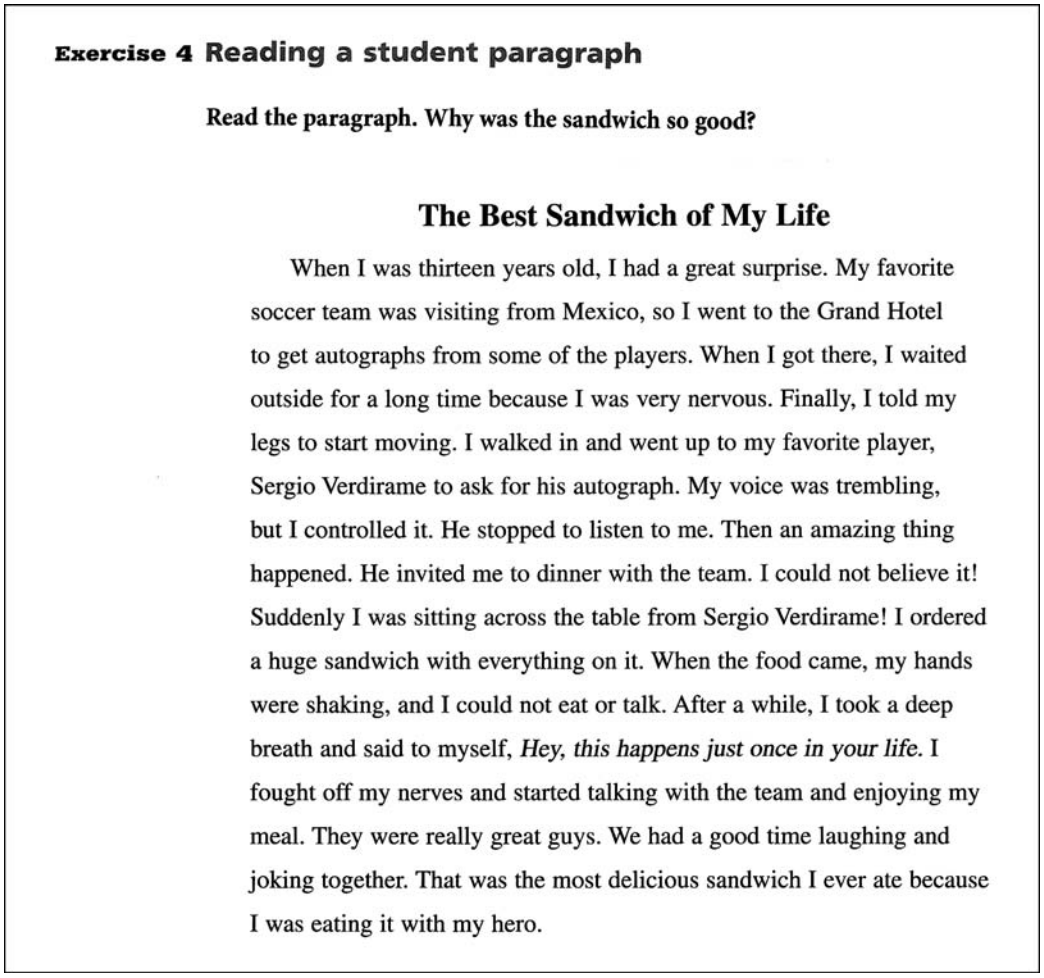


Figure B Example from the 'Effective Academic Writing' Textbook (2012)



Exercise 4 Reading a student paragraph

Read the paragraph. Why was the sandwich so good?

The Best Sandwich of My Life

When I was thirteen years old, I had a great surprise. My favorite soccer team was visiting from Mexico, so I went to the Grand Hotel to get autographs from some of the players. When I got there, I waited outside for a long time because I was very nervous. Finally, I told my legs to start moving. I walked in and went up to my favorite player, Sergio Verdirame to ask for his autograph. My voice was trembling, but I controlled it. He stopped to listen to me. Then an amazing thing happened. He invited me to dinner with the team. I could not believe it! Suddenly I was sitting across the table from Sergio Verdirame! I ordered a huge sandwich with everything on it. When the food came, my hands were shaking, and I could not eat or talk. After a while, I took a deep breath and said to myself, *Hey, this happens just once in your life.* I fought off my nerves and started talking with the team and enjoying my meal. They were really great guys. We had a good time laughing and joking together. That was the most delicious sandwich I ever ate because I was eating it with my hero.

Figure C Example from the 'Effective Academic Writing' Textbook (2012)

vocabulary specific to their particular fields. The first year writing students at this university, however, are required to buy a textbook called "Effective Academic Writing" (Savage & Shafiei, 2012) that has assignments that ask students to write (for example) about their favorite color (See Figures B and C), and provides model paragraphs detailing a short story about a red couch (p.26) or the best sandwich of one's life (p.110). It can be argued that students could instead benefit more by starting to prepare for real upcoming needs such as writing a research report in English or presenting their research.

In first year classes, for example, there are a number of ways to teach ESP writing at a level that lower level students will have few problems comprehending. For example, let's take the 'best sandwich' topic mentioned in the academic English writ-

ing textbook. This could easily be reoriented from a general EAP lesson on paragraph construction for an essay to a more ESP style approach geared to science students. Students could instead write about the process of making a sandwich, including detailed steps on its preparations. This would help students to not only learn about what a methodology is, but also develop the ability to utilize various process and transition words that they could then use in their presentation scripts and research reports in English in the future. Finally, this sandwich making process could be compared to an actual research methodology taken from a primary source to show how close students' examples of transition and process words were to the actual example.

Writing teachers at science universities, then, can help their science and technology students prepare for the upcoming task of becoming members of their field not only in Japan, but internationally as well. First of all, second year students at many science universities have the immediate need of choosing a particular laboratory for the following academic year. The Department of Chemistry students will need to choose, for example, from among 14 different chemistry laboratories at this university, which all have different foci. Fortunately, this university has both Japanese and English language websites for all of its science majors where students can find detailed information about each department's goals and structure, including the various laboratories each faculty has. One writing assignment that can help students to choose a laboratory and become more acquainted with their major is seen in Appendix A. In an earlier assignment students not only have to explain what their major is in English, but they also have to choose a laboratory they are interested in joining. They need to outline what kind of research that laboratory is conducting. Students also have to ascertain the laboratory's purpose and goals. In this follow-up assignment (Appendix A) students choose one particular research project from their chosen lab and need to learn about this research and also about the elements of a research paper in their chosen field. These ESP writing assignments serve two purposes. First, they help second year students to embark on the process of entering into their own fields of study. Second, they allow students to begin the lengthy process of learning a set of vocabulary and terminology, both in English and Japanese, that may be specific to their individual majors. In addition, the teacher can learn more about the students' fields of study. This provides a real purpose for the students: explaining their field and research to others, which is a useful skill, for example, when presenting at conferences. From the sociocultural perspective, these types of ESP writing assignments can connect students to a real community outside the classroom and may provide more motivation to students than general essay topics that are not specific to students' majors.

IV. Implications and Conclusions

It has been suggested that it would be too difficult for an instructor tasked with teaching various science majors to create an individualized syllabus that meets the needs of each student or major. However, as I have outlined in this paper, it is possible to meet the needs of students without overwhelming the teacher if the view of the teacher as the authoritative figure in terms of knowledge is changed to the teacher as mediator, facilitator and learner of knowledge. Students can search for research projects in their labs of choice and find out about their majors, whilst transmitting that knowledge to the teacher and learning about specialized terminology in the process. The teacher, then, can help students structure their ideas, introduce them to certain rules and conventions of communities of practice, like those involved with international conferences. An English writing curriculum for science majors in Japan, therefore, can and should meet the needs of students who will have a difficult time with reading, writing and presenting scientific research in English unless they start preparing from the very start of their university careers. Strengthening the case for an ESP constructivist approach, is the view expressed by the students themselves, whose number one desire (60%) was to write research reports related to their own majors. With some curriculum planning and design, undergraduate writing courses at Japanese universities could become an integral part of a student's transition from student to researcher, and from an outsider in their particular scientific field to member of that field. The ESP constructivist classroom meets this particular institution's goals as well, by helping to achieve the school's stated goals of creating internationally oriented scientists capable of performing jobs and activities in international settings. The undergraduate English writing curriculum, then, could become a crucial element in the process of creating internationally minded scientists.

Appendix A—Example Assignment for an Undergraduate ESL Science Writing Course

1) Choose one research project from your chosen lab. It can be a research project that is currently being conducted. Or it can be a research project that has already finished. Please do not choose a research project that has just started because there will not be a lot of information on that research project. It's better to choose a research project that has been going on for some time or that has recently finished. There will be much more information for these projects. (IF you cannot find any information on any project from your chosen lab you may choose another lab in your department).
2) Find out as much information, in Japanese and English (if available) as you can about this project. Talk to your sempai and teachers. Look at the website. Gather all the information you can.

3) You will need to find the following things:
   A) What is the study?
      • Title of the research project − What is it called?
      • Project start date − When did this project or study begin? (If you cannot find this information online perhaps ask one of your sempais or a teacher)
      • Length of project − How long has it been going on? How long did it take? (If you cannot find this information online perhaps ask one of your sempais or a teacher)
      • Central concept or idea − What is the basic concept or central idea of this research project or study?
   B) Who is doing the study?
      • Project lead − Who is(are) the main professor(s) in charge of this project?
      • Major project researchers − How many graduate students are working on the project?
      • Minor researchers − How many undergraduate students are involved in the project?
   C) What is the purpose of the study?
      • Purpose − What is the major goal of the study or project?
      • Implications − If the researchers achieve their goal (目標を達成したら) what effects might this have (どんな影響になる) on society, people, or science? For example, if your project is about making medicine then talk about how that medicine will help people.

Example:

(A)
   • Title_____
   • Start date_____
   • Length of study_____
   • A few sentences about the central idea/concept of the project or research

     _____

     _____

(B)
   • Lead researcher_____
   • Major researchers (if any)_____
   • Minor researchers (if any)_____

(C)
   • The goal of the study/project is to. . .____

     _____

     _____

   • If they achieve their goal they can . . .[help people to . . .]

     _____

     _____

     _____

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